LETTERS TO THE EDITOR.

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Warning Colours.

IN the experiments on "Comparative Palatability," recorded in NATURE of November 19 (p. 53), Mr. E. B. Titchener refers to the unpalatability of the brimstone butterfly. The insect was "fairly seized several times," but "was always rejected," by a frog. Some of your readers may not be aware that Mr. F. Gowland Hopkins, of Guy's Hospital, has recently shown that the yellow pigment of this butterfly, and of several others of its allies, is due to a substance formed as a urinary pigment; it is also known that the colours of other butterflies, and other animals, bear a relation to the urinary pigments. These substances may be in many cases of a disagreeable flavour. Dr. Eisig, of the Naples Zoological Station, has suggested that if intense and varied coloration is primarily due to a great quantity and variety of such bitter-tasting pigments, we do not need to assume that the brilliant coloration has been brought about in order to advertise the nauseous taste. The bright and varied colour will be, in fact, a consequence of the deposition in the integument of bitter pigments. This view—which has for the most part escaped the attention of those who have written upon animal colours, owing doubtless to its having been put forward in a special monograph upon a group of worms (*Capitellidæ*)—better explains how it is that brightly-coloured unpalatable creatures are in so many (? the majority of) cases tasted before being refused. I have laid some stress upon this view of warning coloration in a forthcoming book upon "Animal Coloration," which is to be published by Messrs. Swan Sonnenschein and Co. FRANK E. BEDDARD.

Zoological Society's Gardens, Regent's Park.

The Salts in Natural Waters.

THE communication of Mr. Lyons, in NATURE of November 12 (vol. xlv. p. 30), giving an analysis of the water of the salt lake of Aalia Paakai, affords a suitable opportunity for asking a question, to which, I trust, some chemist among the readers of NATURE will be able to give a satisfactory answer.

The usual analysis of the "solid constituents" of a given specimen of natural water only *directly* determines, I believe, the respective quantities of the metallic bases—sodium, calcium, &c.—and of the non-metallic constituents—chlorine, carbonic acid, &c.—contained in the "total solids." How does the chemist, then, proceed to mate these two classes of constituents together, so as to be able to state with confidence what salts, and in what quantities, are held in solution in the water? The problem itself would appear to be an *indeterminate* one, at any rate if there are more than two of either class of constituents. What additional considerations are introduced to render the problem determinate? Are they definite chemical conditions; or is there more or less arbitrariness in the assumptions made, so that two chemists would not necessarily arrive at the same result?

In the case of the Honolulu lake, there are, according to Mr. Lyons's analysis, three non-metallic constituents (*chlorine, bromine, sulphuric acid*)—(is not the absence of *carbonic acid* remarkable?)—and four metals (*sodium, potassium, calcium, magnesium*); the quantities of which have, I suppose, been obtained by direct analysis. From the *twelve* possible combinations of these constituents to form simple salts, *five* have been excluded, the sulphates of sodium and potassium, and the bromides of these metals and calcium also, thus reducing the number to *seven*, the quantities of which can, of course, be definitely determined from the *seven* direct data of the analysis. Is it *certain*, however, on assured chemical grounds, that none of these excluded salts are contained in the water, and if not, on what principle has their possible existence been ignored?

I write, as is evident, with but very slight knowledge of chemical analysis; and possibly answers to my questions are to be found in some text-book. If so, I should be obliged by a reference to any easily accessible work in which the question is discussed. R. B. H.

Mental Arithmetic.

THE following method of multiplying large numbers together mentally, if new, may interest some of your readers. If it has been published before, I should be glad to learn where it may be found. The process is so simple that, though I have no special gift for mental arithmetic, I was able, almost without practice, to multiply together correctly seven figures by seven, and to write down the result from left to right.

Suppose it is desired to multiply 123 by 456. The sum is usually written thus:—

$$\begin{array}{r} 123 \\ 456 \\ \hline 738 \\ 615 \\ 492 \\ \hline 56088 \end{array}$$

If, instead of completing each step in the multiplication as we arrive at it, and carrying the tens to the left, the digits are merely connected by the multiplication sign and written down in their proper places, the result is:—

$$\begin{array}{ccccc} & & 1 & 2 & 3 \\ & & 4 & 5 & 6 \\ \cline{3-5} & & 1\times6 & 2\times6 & 3\times6 \\ & 1\times5 & 2\times5 & 3\times5 & \\ 1\times4 & 2\times4 & 3\times4 & & \\ \hline 1\times4 & (1\times5+2\times4) & (1\times6+2\times5+3\times4) & (2\times6+3\times5) & 3\times6 \end{array}$$

If the figures in the lowest line are multiplied out and the tens carried to the left in the usual way, the result is, of course, the same as that given by the ordinary procedure. Thus, to obtain the first figure, beginning at the right, we say: "$3 \times 6 = 18$;—8 and carry 1." To obtain the second figure: "$2 \times 6 = 12$; $3 \times 5 = 15$; $12 + 15 + 1$ (which has been carried) $= 28$;—8 and carry 2." And so on. Thus each figure of the answer can be obtained by multiplying together certain digits of the multiplier and multiplicand, and adding the amount to be carried from the calculation of the previous figure, without the strain of remembering all the horizontal rows of results and their relative positions vertically. It remains only to show which digits of the multiplier and multiplicand must be combined. A consideration of the example worked out above will show that, to obtain the first figure of the answer, we multiply the 1st digit (from the right) of the multiplier (6) by the 1st of the multiplicand (3). To obtain the second, we multiply the 1st of the multiplier by the 2nd of the multiplicand and the 2nd of the multiplier by the 1st of the multiplicand (*i.e.* the first two of each line) crosswise, and add the products. Similarly, the third figure is obtained by multiplying the first three digits of each line crosswise, *i.e.* 1st by 3rd, 2nd by 2nd, and 3rd by 1st, and adding the products. The number of digits employed in the process is now at a maximum, and begins to diminish. To obtain the fourth figure, we multiply together crosswise all the digits except the first of each line, *i.e.* the group $\begin{smallmatrix}12\\45\end{smallmatrix}$. And to obtain the last figure, we multiply all except the first two of each line, *i.e.* the group $\begin{smallmatrix}1\\4\end{smallmatrix}$.

If the number of digits in the multiplier is less than that in the multiplicand, the procedure is the same till all the digits of the multiplier are used in the combination. For each successive figure, the group of digits in the multiplicand to be used shifts along one place to the left till it comes to the end. The group then diminishes as before, by dropping the right-hand digit in each line. For example: the groups, the digits of which are multiplied together crosswise, in multiplying 123456 by 789, are as follows:—

Digits—	8th.	7th.	6th.	5th.	4th.	3rd.	2nd.	1st
	1	12	123	234	345	456	56	6
	7	78	789	789	789	789	89	9

It will be found, on trial, that this method is quite easy, and can be accomplished by anyone who can add together in his head the products of two digits, and can remember the string of figures which form the answer. This is most easily done by

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repeating the whole series from left to right, as each successive figure is arrived at.

The power of multiplying as many as seven figures by seven is not likely to be of much practical value, and when carried to this stage the method is merely a curiosity; but it may be of use in helping us to multiply together small amounts, consisting of two or three digits, which lie beyond the scope of the multiplication table.

I will conclude with a short example, showing what passes through the mind in working the method.

Multiply 987 by 654.

987
654

First figure.—$4 \times 7 = 28$. Eight and carry two.
Answer (so far) 8

Second figure.—$4 \times 8 = 32 + 2$ (carried) $= 34 + 5 \times 7\ (= 35) = 69$. Nine and carry six. Answer (so far) 98

Third figure.—$4 \times 9 = 36 + 6$ (carried) $= 42 + 5 \times 8\ (= 40) = 82 + 6 \times 7\ (= 42) = 124$. Four and carry twelve. Answer (so far) 498

Fourth figure.—$5 \times 9 = 45 + 12$ (carried) $= 57 + 6 \times 8\ (= 48) = 105$. Five and carry ten. Answer (so far) 5498

Fifth and sixth figures.—$6 \times 9 = 54 + 10$ (carried) $= 64$. Answer 645498

CLIVE CUTHBERTSON.

A Rare Phenomenon.

I HAVE read with much interest the accounts of "the rare phenomenon" observed by several of your correspondents (published in NATURE, vol. xliv. pp. 494, 519), as I noticed a similar appearance here in Nova Scotia, at about the same time (September 11).

A narrow ray—apparently of auroral light—spanned the whole heavens from east to west, passing overhead a little to the south of the zenith. There was little or no display of auroral light in the north at the time.

A "harvest-home" was held here on September 11, and I noticed the appearance, I think, the same evening about 11 o'clock.

A number of persons in the town of Baddeck observed the same or a similar phenomenon "very shortly before September 12."

ALEXANDER GRAHAM BELL.

Beinn Bhreagh, near Baddeck, Cape Breton, N.S.,
November 6.

HENRY NOTTIDGE MOSELEY, F.R.S.

I HAVE been asked to write for the readers of NATURE some account of my dear friend Moseley, who, after an illness which removed him from all active life and work for more than four years, died at Clevedon, in Somersetshire, on November 10. He was only forty-seven years of age; and when seized with the illness which necessitated his retirement from active life, was at the zenith of a wonderful career of scientific productiveness and value. He had for six years held the Linacre Professorship of Human and Comparative Anatomy in the University of Oxford; and by his great energy and commanding talent had succeeded in collecting around him a most promising band of younger men devoted to the investigation of embryological and morphological problems. Baldwin Spencer, Gilbert C. Bourne, S. J. Hickson, and G. Herbert Fowler, were his pupils, and have shown by their numerous published works the value of the teaching and impulse which he gave to them. In the early days of his illness (1887), he was cheered by receiving from the Royal Society the Royal Medal, in recognition of the value of his researches on Peripatus, the Hydrocorallinæ, the Land Planarians, and the Chitons. The blow caused by his serious illness was felt not only in the scientific and social life of Oxford, but in many other centres. We missed his valuable and practical help in carrying to completion the Plymouth Laboratory of the Marine Biological Association, of which he had been a most active and enthusiastic promoter; in the editorship of the *Quarterly Journal of Microscopical Science* I found myself once more deprived of the aid of my most valued comrade, as I had been but a few years previously when Frank Balfour died. The readers of NATURE and of the *Athenæum* missed his varied and always strongly-original contributions; and the Zoological, Anthropological, and Royal Societies had to regret his absence from their meetings and Councils. Moseley had, moreover, at this time made it a practice to give evening lectures in the larger provincial towns as well as in London: from all quarters came expressions of the deep regret which his retirement from public work excited. The amount and variety of work in which he engaged, in addition to the remarkable and extraordinarily minute course of lectures and laboratory work provided by him for his pupils, were certainly more than was wise for him to undertake. But it was a strange and to him a disastrous fact that he never felt tired. He was an exceedingly strong man, and I never saw him fatigued either by physical or mental exertion.

We made acquaintance in Rolleston's laboratory at the Oxford University Museum in 1866, and became fast friends and constant companions. Moseley's father was a distinguished mathematician and Canon of Bristol, Rector of Olvaston, near the Severn. Here, when I was staying with Moseley in 1871, we dissected and prepared the skeleton of a huge grampus which is now in the Oxford Museum; the carcass had made a tour of the neighbouring villages for three weeks before we obtained possession of it. Moseley was at school at Harrow, where he chiefly occupied himself in birds'-nesting and "bug-hunting," in conjunction with a small band of kindred spirits. He was essentially a sportsman, knew every kind of game and how to pursue it. He thoroughly disliked the ordinary routine of school work, such as it was in those days, and it was not until he had entered at Exeter College, and come under the teaching of the late Prof. Rolleston, that his really keen and remarkable intellectual powers began to show themselves. He had somehow developed in early youth the most deep-rooted scepticism which I ever came across among men of my own age; hence it was the *reality* of the work which he did in the dissecting-room at the Museum which delighted him and gave him confidence that there was "something in it" worthy of his intellectual effort. With unfeigned astonishment he would say, on dissecting out the nervous system of a mollusk or some such structure, "It is like the picture, after all!" He had a profound disbelief in the statements made in books unless he could verify them for himself, and it was this habit of mind, perceived and encouraged by Rolleston, which made him in after life so admirable an observer and so successful as a discoverer of new facts. Rolleston used to say that you had only to put down Moseley on a hill-side with a piece of string and an old nail, and in an hour or two he would have discovered some natural object of surpassing interest. He took great interest in all games, and was himself a first-rate racket-player. In the vacations he got a fair amount of shooting, and spent one "long" shooting and fishing in Norway. In the summer of 1867 we visited the Channel Islands together, for the purpose of studying marine animals. Whilst in Sark, after I had left him, he made the acquaintance of an American painter named Dix, and discovered himself to be no mean artist, bringing back a number of really clever water-colours, his first attempts in that direction. At this time and throughout his life, those who met him were struck by his singularly soft and agreeable voice, and by his great courtesy and power of interesting, I may even say fascinating, the most unpromising and unlikely of the companions amongst whom he chanced to find himself—I mean stiff old gentlemen and demure old ladies. To companions of his own age he

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